



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/574,466

02/12/2007

Christiaan Johannes Kooij

8459.016.US0000

2556

77213

7590

09/16/2008

Novak Druce + Quigg, LLP  
1300 Eye Street, NW, Suite 1000  
Suite 1000, West Tower  
Washington, DC 20005

EXAMINER

TAKEUCHI, YOSHITOSHI

ART UNIT

PAPER NUMBER

4162

MAIL DATE

DELIVERY MODE

09/16/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/574,466	<b>Applicant(s)</b> KOOIJ, CHRISTIAAN JOHANNES	
	<b>Examiner</b> YOSHITOSHI TAKEUCHI	<b>Art Unit</b> 4162	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 22-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 and 27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 March 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                        |                                                                   |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12 May 2008 &amp; 31 Mar 2006</u> .                           | 6) <input type="checkbox"/> Other: _____                          |

**DETAILED ACTION**

***Election/Restrictions***

1. Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claim(s) 1-21, and 27, drawn to a method of reducing a metal-oxygen compound wherein carbon acts as a reducing agent.

Group II, claim(s) 22-26, drawn to an apparatus for carrying out the reduction of a metal-oxygen compound wherein carbon acts as a reducing agent.

2. The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the apparatus of Group II requires a first and second reaction chamber with a transport means for transferring the solid charge from the first stage into the second stage, but Group I does not require two reaction chambers or a transport means for transferring the solid charge from the first stage into the second stage.

3. During a telephone conversation with Mr. Anthony Venturino on August 27 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-21 and 27. Affirmation of this election must be made by applicant in replying to this Office action. Claims 22-26 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 5-10, 13-17, 19-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Stephens, Jr. (US 4,053,301). Stephens teaches a method of reducing a metal-oxygen compound comprising a two stage method of transforming iron oxide to steel. Stephens teaches in a first reaction stage, passing CO gas into a reaction chamber containing said an iron-oxygen compound (column 2, lines 9-26) under conditions such that CO is converted to solid carbon and carbon dioxide thereby introducing the solid carbon so formed to said iron-oxygen compound (column 2, lines 1-4, where an excess of carbon is available to supply sufficient heat upon combustion), and in a second reaction stage, where the carbon was introduced to the iron - oxygen compound in the first reaction stage, reduces the iron-oxygen compound (column 1, lines 61-64), to iron-carbide (column 1, line 62, where iron carbide under the circumstances taught by Stephens inherently promotes both the reduction of iron oxide to iron carbide and the Boudouard

Art Unit: 4162

chemical reaction of carbon monoxide to carbon and carbon dioxide. The iron carbide is a promoter for both the first reaction (the Boudouard chemical reaction) and the second reaction (the iron oxide to iron carbide chemical reaction)).

Regarding claim **2**, Stephens teaches a continuous operation, said first and second reaction stages being performed simultaneously (column 2, lines 16-17) and said metal-oxygen compound being moved from a first reaction region where said first reaction stage takes place to a second reaction region where said second reaction stage takes place (implied since the off-gas from step 2 is circulated back to step 1, column 2, lines 9-12).

Regarding claim **3**, Stephens teaches the use of CO gas in the first reaction stage, where the CO was formed in the second reaction stage. (Column 2, lines 9-12).

Regarding claim **5**, **7**, **8** and **9** Stephens teaches the presence of iron carbide (column 1, lines 61-66) while CO reacts into carbon and carbon dioxide (column 3, lines 63-64). The iron carbide is well known to be a promoter for this reaction, which is also known as a Boudouard reaction, so inherently will promote this reaction. In addition, the iron carbide promotes both the second reaction (iron oxide to iron carbide), so the iron carbide is a promoter for two reactions.

Regarding claim **6** and **10**, Stephens teaches the use of particulate iron oxide (column 1, line 61, where “particulate” is understood to mean a tiny particle suspended in a gas), which transforms to iron carbide (column 1, line 62) in a fluidized bed (column 1, line 63). The temperature does not exceed 1,300°F (column 1, line 68), which is a sufficiently low temperature that the iron oxide and iron carbide remain in solid form.

Art Unit: 4162

Regarding claim **13** and **15**, Stephens teaches the direct production of steel from particulate iron oxide. (Column 1, lines 60-61).

Regarding claim **14**, Stephens teaches the first reaction stage performed at a carburizing temperature not to exceed about 1300°F, with a preferred temperature range being about 900°F to 1,200°F (column 1, line 67 to column 2, line 1). The temperature of 900°F is about 482°C, which is below 650°C.

Regarding claim **16**, Stephens teaches the presence of iron carbide. (Column 1, line 62).

Regarding claim **17**, Stephens teaches no added heat is necessary if steps 1 and 2 are close-coupled so that the iron carbide from the fluid bed is at an elevated temperature of about 1,100°F to 1,300°F. (Column 5, lines 9-14). So the second stage in a close-coupled process will be about 1,100°F (593°C) to 1,300°F (704°C), which is between 550°C and 900°C.

Regarding claim **19**, Stephens suggests that a blast furnace can be used in the process taught, but to reduce costs of a “highly fuel-consuming blast furnace” (column 1, lines 14-17), instead uses a basic oxygen furnace or electric furnace is used (abstract). In addition, Stephens teaches the use of a fluidized bed. (Column 1, line 63).

Regarding claim **20**, both the Boudouard reaction (carbon monoxide to carbon and carbon dioxide reaction) and the iron oxide to iron carbide reaction occurs in the fluidized bed unit of Figure 1, so the substantially solid reaction product (iron carbide) produced in the second reaction stage is made available to the first reaction stage, where carbon monoxide forms carbon and carbon dioxide.

Regarding claim **21**, Stephens teaches that the off-gasses, which are about 90% carbon monoxide, from the stage 2 reaction are re-circulated to the stage 1 reaction. (Column 1, lines 9-12).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claim **4** is rejected under 35 U.S.C. 103(a) as being unpatentable over Stephens, Jr. (US 4,053,301). Stephens teaches a method of reducing a metal-oxygen compound comprising a two stage method of transforming iron oxide to steel. Stephens teaches in a first reaction stage, passing CO gas into a reaction chamber containing said an iron-oxygen compound (column 2, lines 9-26) under conditions such that CO is converted to solid carbon and carbon dioxide

Art Unit: 4162

thereby introducing the solid carbon so formed to said iron-oxygen compound (column 2, lines 1-4, where an excess of carbon is available to supply sufficient heat upon combustion), and in a second reaction stage, where the carbon was introduced to the iron -oxygen compound in the first reaction stage, reduces the iron-oxygen compound (column 1, lines 61-64), to iron-carbide (column 1, line 62, where iron carbide under the circumstances taught by Stephens inherently promotes both the reduction of iron oxide to iron carbide and the Boudouard chemical reaction of carbon monoxide to carbon and carbon dioxide. The iron carbide is a promoter for both the first reaction (the Boudouard chemical reaction) and the second reaction (the iron oxide to iron carbide chemical reaction)).

Stephens does not teach the second reaction stage performed at a higher temperature than said first reaction stage. However, Stephens teaches that the second stage is at an elevated temperature of about 1,100°F to 1,300°F. (Column 5, lines 9-14). As a result, it would not be inventive to discover the workable ranges by routine experimentation of the invention taught by Stephens because “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” In re Aller, 220 F.2d 454, 456 (CCPA 1955).

10. Claims 11, 12, 18 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stephens, Jr. (US 4,053,301) in view of the article Reduction and Sintering of Fluxed Iron Ore Pellets—A Comprehensive Review (hereafter referred to as, “article”) (S. Prakash, Reduction and Sintering of Fluxed Iron Ore Pellets—A Comprehensive Review, The Journal of the South African Institute of Mining and Metallurgy, Jan./Feb. 1996, at 3). While Stephens teaches the use

Art Unit: 4162

of an iron-oxide compound, Stephens does not teach a mixture of at least two metal-oxygen compounds. The article teaches a method of reducing iron ore pellets. (Synopsis).

Regarding claim **11, 12, 27**, the article teaches at higher temperatures that a ferrite phase tends to grow on iron ore, progressively producing bridges that consolidate and form aggregate particles. (Page 12, column 1, paragraph 3). As a result, it would have been obvious to a person of ordinary skill at the time of the invention that a ferrite phase would grow on the iron ore during the process taught by Stephens, such that a ferrite phase would bridge to other particles of iron oxide and iron carbide, resulting in conglomerates of particles composed of iron oxide and iron carbide.

Regarding claim **18**, the article teaches that nickel-oxide is a useful catalyst for a direct-reduction of iron oxide to iron carbide. (Page 9, column 1, paragraph 4). As a result, it would have been obvious to a person of ordinary skill at the time of the invention to incorporate both iron-oxide and nickel-oxide in the Stephens process of directly reducing iron ore to steel because the starting material contains iron-oxide and nickel-oxide is another catalyst (in addition to iron carbide) that can reduce iron oxide to iron carbide.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to YOSHITOSHI TAKEUCHI whose telephone number is (571) 270-5828. The examiner can normally be reached on Monday-Thursday 9:30-3:00.

Art Unit: 4162

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571) 272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Yoshitoshi Takeuchi/

/Jennifer McNeil/  
Supervisory Patent Examiner, Art Unit 4162